



Application No. 10/816,955
Attorney Docket No. 042322

Response under 37 C.F.R. §1.111
Response filed: November 9, 2006

REMARKS

Claims 1-20 are pending in the present application. Claims 12-20 are withdrawn from consideration. Claims 1-11 are rejected.

Objections to the Specification

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. The Examiner objects to the specification and asserts that the specification does not explicitly spell out the limitation of “without any hydrophilic insulation film between the second low dielectric constant film of said another second inter-layer insulation film and the diffusion preventing film of said one second inter-layer insulation film” in claim 10 clearly.

Applicants submit that the descriptions in the specification sufficiently support the limitation in claim 10 and thus proper antecedent basis for the claimed subject matter is provided in the current specification.

Applicants submit that the limitation in claim 10 referenced by the Examiner has its basis on the descriptions regarding the layered structure of the insulation films in the intermediate layer interconnection part 14 (page 27, lines 6-11, and page 28, lines 14-18 in the original specification which were amended in the Substitute Specification submitted in response to the Office Action dated May 25, 2005) and the descriptions explaining the feature of the layered structure of the insulation films in the intermediate interconnection part 14 in comparison with that in the lower interconnection part 12 from the viewpoint whether hydrophilic insulation film

is formed or not (page 31, line 3-page 33, line 20, especially page 31, lines 13-20, and page 33, lines 7-12) in the specification as well as in the drawing. The followings are the descriptions on page 31, lines 13-20, and on page 33, lines 7-12, respectively:

“...in the intermediate interconnection part 14, in which the interconnection layers has the interconnection patterns of a larger pitch than the interconnection patterns of the interconnection layers of the lower interconnection part 12, the SiC film functioning as the diffusion preventing film is formed directly on the low-k film, without any hydrophilic insulation film formed.”

“Thus, in the intermediate interconnection part 14, the SiC film functioning the diffusion preventing film is formed directly on the low-k film, and the hydrophilic insulation film, whose dielectric constant is higher than that of the low-k film, is not formed.”

From these descriptions, together with the descriptions regarding the layered structures of the insulation films in the intermediate interconnection part 14 and the lower interconnection part 12, it is clear that the diffusion preventing film is formed directly on the low-k film, without any hydrophilic insulation film between the low-k film and the diffusion preventing film in the intermediate interconnection part 14. Applicants submit that the descriptions in the specification sufficiently support the limitation in claim 10 and thus proper antecedent basis for the claimed subject matter is provided in the current specification.

Claim Rejections under 35 U.S.C. 112, first paragraph

Claim 1 and dependent claims 2-9 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

The Examiner points out that the disclosure does not have support for the limitation of “a diffusion preventing film formed directly on upper surfaces of the second low dielectric constant film and the second interconnection layer, without any hydrophilic insulation film between the second low dielectric constant film and the diffusion preventing film” as recited in claim 1.

The correspondences between the constituents of claim 1 and the members disclosed in the embodiment are as follows: the first interconnection layer corresponds to one of the interconnection layers in the lower interconnection part 12, while the second interconnection layer corresponds to one of the interconnection layers in the intermediate interconnection part 14; the diffusion preventing film the Examiner questions corresponds to the SiC film functioning the diffusion preventing film in the intermediate interconnection part 14.

The limitation regarding the diffusion preventing film in claim 1 that the diffusion preventing film is formed directly on upper surfaces of the second low dielectric constant film and the second interconnection layer, without any hydrophilic insulation film between the second low dielectric constant film and the diffusion preventing film has the same basis as the limitation in claim 10 has. Namely, the limitation in claim 1 is based on the descriptions regarding the layered structure of the insulation films in the intermediate layer interconnection part 14 (page 27, lines 6-11, and page 28, lines 14-18) and the descriptions explaining the feature of the layered

structure of the insulation films in the intermediate interconnection part 14 (page 31, line 3-page 33, line 20, especially page 31, lines 13-20, and page 33, lines 7-12).

The Examiner indicates that claim 10 would be allowable. Applicants note that the difference between claim 1 and claim 10 is whether or not the structure is limited to the multilayer interconnection structure including a plurality of interconnections. That is, claim 10 is limited to the multilayer interconnection structure which has the first multilayer interconnection layer including a plurality of interconnection layers whose minimum interconnection pitch is a first pitch and the second multilayer interconnection layer including a plurality of interconnection layers whose minimum interconnection pitch is a second pitch larger than the first pitch. On the other hand, claim 1 is directed to a semiconductor device having the structure including the first interconnection layer whose minimum interconnection pitch is a first pitch and the second interconnection layer whose minimum interconnection pitch is a second pitch larger than the first pitch. Claim 1 is broader than claim 10, because it is not limited to a multilayer interconnection structure. There is no difference between claim 1 and claim 10 in the fundamental idea in connection with the layered structures of insulation films with or without hydrophilic insulation film according to minimum pitches of interconnection layers buried therein.

The limitation in claim 1 is also supported in the specification similarly to the limitation in claim 10 as described above. That is, the limitation has its basis on the descriptions regarding the layered structure of the insulation films in the intermediate layer interconnection part 14 (page 27, lines 6-11, and page 28, lines 14-18 in the original specification which were amended

in the Substitute Specification submitted in response to the Office Action dated May 25, 2005) and the descriptions explaining the feature of the layered structure of the insulation films in the intermediate interconnection part 14 in comparison with that in the lower interconnection part 12 from the viewpoint whether hydrophilic insulation film is formed or not (page 31, line 3-page 33, line 20, especially page 31, lines 13-20, and page 33, lines 7-12) in the specification as well as in the drawing. The descriptions on page 31, lines 13-20, and on page 33, lines 7-12, read as follows, respectively:

“...in the intermediate interconnection part 14, in which the interconnection layers has the interconnection patterns of a larger pitch than the interconnection patterns of the interconnection layers of the lower interconnection part 12, the SiC film functioning as the diffusion preventing film is formed directly on the low-k film, without any hydrophilic insulation film formed.”

“Thus, in the intermediate interconnection part 14, the SiC film functioning the diffusion preventing film is formed directly on the low-k film, and the hydrophilic insulation film, whose dielectric constant is higher than that of the low-k film, is not formed.”

From these descriptions, together with the descriptions regarding the layered structures of the insulation films in the intermediate interconnection part 14 and the lower interconnection part 12, it is clear that the diffusion preventing film is formed directly on the low-k film, without any hydrophilic insulation film between the low-k film and the diffusion preventing film in the intermediate interconnection part 14. Applicants submit that the descriptions in the specification

sufficiently support the limitation in claim 1 and thus proper antecedent basis for the claimed subject matter is provided in the current specification.

While the embodiment discloses the structure of the semiconductor device that both of the lower interconnection part 12 and the intermediate interconnection part 14 have multilayer interconnection structures, it is evident that the present invention offers the idea in connection with the layered structures of insulation films with or without hydrophilic insulation film according to minimum pitches of interconnection layers, whose application is not restricted only to multilayer interconnection structure having two multilayer interconnection parts. The present invention provides widely applicable layered structure of insulation films with interconnection layers buried therein, the interconnection layers having different pitches.

As described above, the disclosure of the present application has support for the limitation of “a diffusion preventing film formed directly on ...” as recited on claim 1 and thus claim 1 and dependent claims 2-29 comply with the written description requirement.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

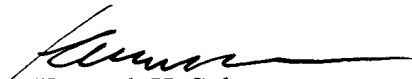
If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

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If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,
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